The Pharma Innovation Journal 2021; SP-10(10): 18-21

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277- 7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2021; SP-10(10): 18-21

www.thepharmajournal.com
Received: 07-08-2021
Accepted: 09-09-2021

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Tapping the untapped potentials of rice-fallow areas in Bhagalpur (Bihar)

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Abstract
Rice crop is considered as the principal crop during the kharif season in the country occupying an area of over 40 million hectare. But during the subsequent rabi season this area is not fully utilized for crop cultivation and remains fallow which accounts for about 30% (11.3 mha) of the area under rice production. These fallow land offers an enormous opportunities for cultivation of short duration pulses and oilseed crops. Crop productivity in rice fallows is generally poor due to various bio-physical, biotic and abiotic stress, poor crop management practices and socio-economic reasons. Soil moisture is the most serious constraints as amount of rainfall received during rabi season is low and erractic. After the harvest of rice, growing of rabi crops will solely depend upon availability of soil moisture. The present study attempts to assess the opportunities available in rice-fallow region and utilizing those untapped potentials of the fallow particularly in Bhagalpur district of Bihar. This will help to understand the scenario at aggregate level and will indicate the factors responsible for rice-fallow area and preventing the crop production during subsequent rabi season. Primary data has been used for this purpose. The findings of the study indicates that rainfed ecology and lack of irrigation is the first and foremost factor followed by low soil moisture residual availability are responsible for leaving the land fallow after cultivation of rice crop during kharif. After the harvest of rice crop this land remains fallow in the subsequent rabi season. This untilized area offers an enormous opportunities to overcome the problem of food and nutritional insecurity of the country.

Keywords: conditions, extent, kharif-fallows, rice-fallows, untapped potentials

Introduction
Indian agriculture is a prelude to economic development and a pre-requisite for poverty alleviation and overall economic development (Ravallion and Dutta, 1996; Singh and Baleka, 1999) [8]. The rice crop occupies an area of over 40 million hectares. This area is not fully utilized for crop production in the subsequent rabi (post rainy) season; about 12 million hectares of the area on which rice is cultivated remains fallow (Subbarao *et al*. 2001) [10]. This unutilized area offers enormous opportunities to overcome the problem of food and nutritional insecurity. Accomplishing household food security remains the primary concern though at the national level India has piled up a huge stock (about 60 million t) of food grains, mainly rice and wheat. Food crops such as pulses and oilseeds are critical to food security. Nutritional security is equally important; about 30% of the population suffer from malnutrition (Kumar and Joshi 1999). A majority of Indian population is vegetarian, deriving its protein requirement from pulses and other vegetarian sources. The per capita availability of pulses has been declining. India is deficit in pulses and edible oils, and imports huge quantities of these commodities to meet the domestic demand. About 30% (11.7 mha) of the area under rice production during kharif season in India remain fallow in the subsequent rabi season due to number of biotic, abiotic and socioeconomic constrains. Despite of ample opportunities rice fallow systems have been bypassed in the research and developments for a numbers of constraints. Major rice fallow area (82%) is concentrated on eastern parts of the country. States with larger area of rice-fallows are Chhattisgarh, Madhya Pradesh, Jharkhand, Bihar, West Bengal and Orissa the remaining 18% area in the states like Tamil Nadu, Karnataka and Andhra Pradesh and there exists a large scope for expansion of area under pulse crops. Short duration pulses are ideal candidates for their cultivation in such areas (Bourai *et al*. 2002) [2].
Crop productivity in rice fallows is generally poor due to various bio-physical, biotic and abiotic stresses, poor crop management practices and socio-economic reasons. Among the abiotic constraints soil and water are the two major limiting factor which leads to low or stagnated pulse production in rice fallows during past several years. Soil moisture is the most

serious constraints for cultivating rabi crops in rice fallow areas. Rice fallow system receive considerable amount of rainfall during kharif season but the amount of rainfall received during the rabi season is low and erratic. Growing of rabi crops solely depends upon the availability of soil moisture in the field after rice harvest. After harvesting of rice crop low moisture content in the soil followed by fast decline in water table with the advancement of rabi season results in mid-and-terminal drought at flowering and pod filling stages and adversely affects the productivity of pulses in rice fallows. Terminal drought and heat stress result in forced maturity and may reduce seed yield by 50% in the tropics. Besides the inherent constraints, rice fallows also affect seed germination, seedling emergence and crop establishment due to disruption of soil structure, soil water deficit, poor aeration and mechanical impedance of the seed zone. Amongst these, soil hardiness is the most limiting factor followed by low organic matter content in the soil. Soil hardiness in the puddle rice fields deteriorates the hydraulic properties of the soil, which adversely affects the soil moisture distribution and root growth of deep rooted pulses. This hostile environment creates potential threat to microbial activity, nutrient availability, root growth (root is mostly confined in top soil layer) and water and nutrients uptake, thus sub-soil resources in rice fallows remain unutilized (Satyanarayana *et al*., 1997).

Material and Methods

The study was conducted in Bhagalpur district of Bihar. The Bihar state was purposively selected for the present study as it has 36.8% of total kharif rice fallow areas. The Bhagalpur district is purposively selected for the present study as the main crop cultivated in this region is rice and it has vast area under rice fallows. Bhagalpur district consists of 16 blocks *viz*., (i) Pirpainti (ii) Kahalgaon (iii) Sanhaula (iv) Sabaur (v) Nathnagar (vi) Jagdishpur (vii) Sultanganj (viii) Sahkund (ix) Bihpur (x) Navgachia (xi) Gopalpur (xii) Kharik (xiii) Narayanpur (xiv) Gauradih (xv) Ismailpur and (xvi) Rangrachowk.

Out of these 16 blocks, Sultanganj block has been purposively selected for the study as the main occupation of the people in this region is agriculture and main crop cultivated in this region is rice crop.

From the selected developmental block, a list of all the villages was prepared and five villages were randomly selected using random table without replacement method. These selected villages are given below:

1. Khanpur Daulatpur
2. Akbarnagar
3. Rasidpur
4. Khanpur
5. Udhadih

From the selected villages the list of farmers growing rice was prepared and was prepared and further classified into four size groups based on their size of holdings *viz*.

Marginal farmer (having <1.25 acres wetland and <2.5 acres dryland)

Small farmer (having 1.25-2.5 acres of wetland and 2.5-5.0 acres dryland)

Medium farmer (5-10 acres holding) and

Large farmer (>10 acres).

From each size group farmers were selected from each village by simple random sampling method. Thus ultimate sample size was 50 respondents which comprised of marginal, small, medium and large farmer. There are 23 marginal, 14 small, 9 medium and 4 large farmers.

The data required for this study was primary in nature. However, the secondary data are pertained to the latest one available in the Department of Agriculture, government of Bihar, Bhagalpur. The primary data was collected through interview method by contacting the respondent of the village. The pre-tested schedule was used for data collection. To achieve the objective of the study, i.e. to study the extent and conditions of rice fallows in Bhagalpur district the various category of farmers simple tabular, graphical and percentage methods have been used.

$$\text{Percentage} = \frac{X_i}{\Sigma X_i} \text{ X } 100$$

$$\text{Mean} = \frac{\text{Sum of observations}}{\text{Total number of observations}}$$

Results and Discussion

In India approximately 11.7 million hectare of the rice cultivated area remains fallow, out of this about 9.72 million ha area remains fallow in the northern states of the country. The northern states account about 82% of the fallow areas which provides enormous potential for the short duration such as pulses. These short-duration crops can be successfully grown by the farmers utilizing the residual moisture which in turn will benefit the farmers by providing extra income to them as well as making the country self sufficient in pulse production. Table 1 shows the existing area under rice fallows in Eastern India out of which West Bengal accounts 1.72 million ha, Jharkhand accounts 1.46 million ha, Odisha accounts 1.22 million ha, Bihar accounts 0.74 million ha, Assam accounts 0.54 million ha and Uttar Pradesh accounts 0.50 million ha of the fallow area after the harvest of Rice crop. It has been reported that approximately 0.74 million ha of the rice fallow area is available in Bihar alone. If this fallow land is utilized in proper ways it can provide vast scope different short duration crops such as pulses and oilseeds.

Table 1: Existing area under the rice-fallows in eastern India

Eastern States	Rice-fallow area (M ha)
West Bengal	1.72
Jharkhand	1.46
Odisha	1.22
Bihar	0.74
Assam	0.54
Uttar Pradesh	0.50

Source: Annual Report DPD (2016-17)

Table 2 represents the suitable crops and its varieties for rice-fallow areas in Eastern India. The crops that can be successfully be grown in different regions of Bihar are lentil, lathyrus, pea, chickpes, mungbean, urdbean, mustard, groundnut, safflower, linseed and toria. These crops can be successfully cultivated in fallow areas after the harvest of rice by selecting the proper varieties of the crop. These crop varieties has the characteristics of drought and disease tolerance which can withstand in a harsh situation such as less moisture availability and attack of various disease and pests. By selecting proper variety of these short duration pulses and oilseed crops, farmers can successfully cultivate after the harvest of the rice crops in their fields. Hence, proper selection of the technology and improved varieties it is possible to utilize these fallow area

Table 2: Suitable crops and varieties for rice–fallow areas of the eastern India

Crops	Varieties	States
Lentil	HUL 57, KLS 218, Narendra Masoor, Arun, DPL 15, DPL 62, Vaibhav, Pusa Masoor, IPL 316, IPL 01, IPL 406, Ranjan, K 75	Assam, West Bengal, Bihar, Odisha, eastern Uttar Pradesh, Chhattisgarh and Jharkhand
Lathyrus	Ratna, Prateek, Mahateora	Tal area Bihar, Chhattisgarh and West Bengal
Pea	Arkel, Azad pea, Rachna	Jharkhand, Chhattisgarh and eastern Uttar Pradesh
Chickpea	GCP 105, Pusa 372, JG 11, JG 14, JG 16, Pant G 186, Rajas, Pusa 547, Pusa 256, Vaibhav, GCP 105, GNG 1581	Chhattisgarh, West Bengal, Bihar and Jharkhand
Mungbean	SML 668, Pusa Vishal, Samrat	Odisha, Chhattisgarh, Jharkhand and Bihar
Urdbean	Navin, T 9, ADT 3, ADT 4	Odisha and Jharkhand
Mustard	Pusa Bold, Kesri Gold	Eastern Uttar Pradesh, Bihar and Jharkhand
Groundnut	JL 24, ICGS 1, TAG 24	Bihar, Odisha and Assam
Safflower	PBNS 12, Manjira, Bhima	Eastern Uttar Pradesh, Bihar and Jharkhand
Linseed	Sweta, Uma, Shekhar, Indu, RLC 133, RLC 138, RLC 143, SLS 79, JLS 95, BAU 06-03, BAU 2012-1, BAUP 101	Eastern Uttar Pradesh, Bihar, Jharkhand, Assam
Toria	TS 36, TS 38, TS 61, M 27	Assam, Bihar and Jharkhand

Source: Modified from Ghosh *et al.* (2016) [6].

In Bhagalpur district total geographical area is 248800 ha out of which cultivable area (net sown area) is 153600 ha. The major crop cultivated in this region is rice which is cultivated on 55100 ha during kharif season which is heavily dependent on rain. Out of this rice cultivated area in the kharif season 21980 ha area remains fallow during rabi season which is not available for cultivation during rabi season due to various constraints prevailing in that particular rice cultivated field. Table 3 represents the rice fallow area in Bhagalpur district.

Table 3: Rice-fallow areas in Bhagalpur district

Particulars	Gross sown area	Net sown area	Rice cultivable area	Rice Fallow area	Percentage of rice fallows
Area (ha)	191100	153600	55100	21980	39.89 %

Source: District. Agriculture Office, Bhagalpur and Gumma *et al.* 2016 [4].

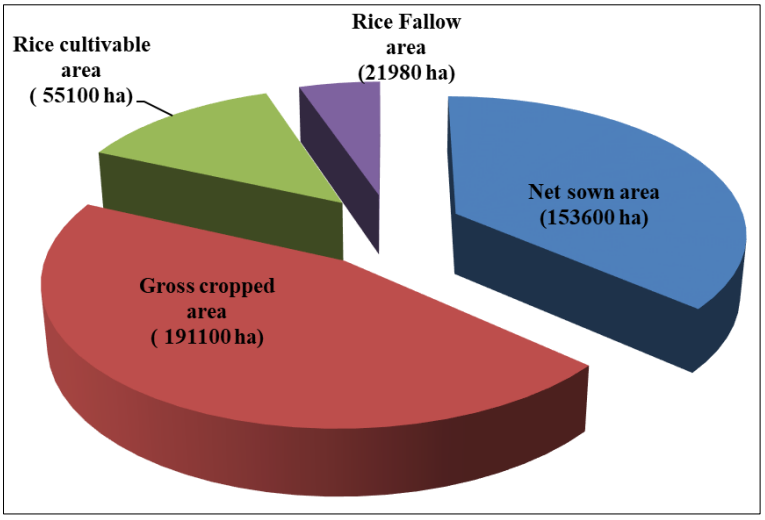

Fig 1: Extent of rice fallow area in Bhagalpur

Table 4 represents the percentage of rice fallow farmers under different categories of sampled farmers and rice fallow area remained after kharif rice cultivation. The total land holding of marginal farmers is 22.45 ha out of which 5.87 ha remains fallow after rice cultivation whereas in case of small sized farmers total land holding size is 50.75 ha and rice fallow area is 14.70 ha which accounts for 27.58 per cent. In case of medium and large sized farmers the total cultivated area is 57 ha and 78 ha respectively, where rice fallow area remains 9.75 ha and 12.5 ha respectively which accounts for 17.10 per cent and 16.02 per cent respectively. The per cent of rice fallow area is relatively lower in case of medium and large farmers than marginal and small sized farmers. The reason for less rice fallow area for large and medium sized farmers could be due to better moisture management practices and improved technologies adopted by the farmers to utilize the fallow land.

Table 4: Percentage rice fallow areas of sampled farmers

Types of Farmers	Percentage of Rice-Fallow
Marginal Farmer	26.15
Small Farmer	27.58
Medium Farmer	17.10
Large Farmer	16.02
Total	20.56

***Source:** compiled from field survey

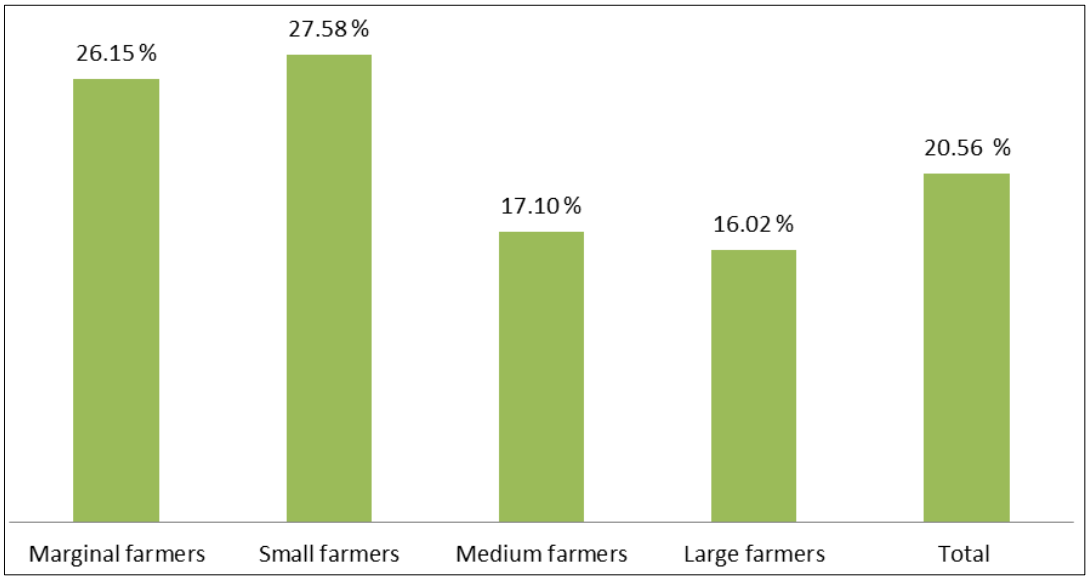

Fig 2: Percentage of rice fallow farmers under different categories

Conclusion

It can be concluded that the percentage of rice fallow in Bhagalpur district was 39.89 per cent while the rice fallow area available in the study area was 20.56 per cent. The major area of the Bhagalpur district remains fallow (about 39%) after kharif rice cultivation because of rainfed ecology as well as less availability of the moisture in the soil which provides vast scope for increasing the food grain production to feed the growing population of the country. By cultivating improved varieties and with the help of new technologies it can be made possible to grow crop in such a situation. The present study was an attempt to analyze the potential of rice fallow areas available in the Bhagalpur district so as to increase the productivity of different crops such as pulses and short duration oilseed crops by bringing the fallow land under further cultivation of the crops.

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